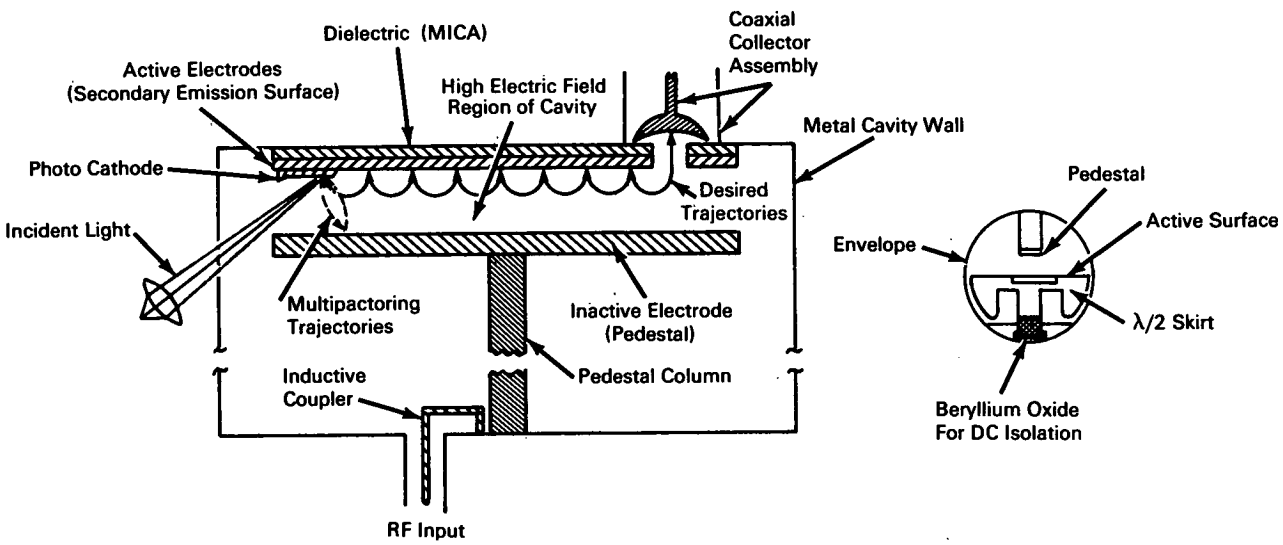
NASA TECH BRIEF

Improved Design Provides Faster Response Time in Photomultiplier



The problem:

To design a dynamic crossed-field electron multiplying (DCFEM) light demodulator that is smaller and easier to fabricate, assemble, and align; to improve the high vacuum envelope; and to provide electrical characteristics as good as or better than the conventional rectangular configuration DCFEM.

The solution:

A DCFEM that avoids the normal response time limitations inherent in static field devices, by using time varying crossed electric and static magnetic fields to eliminate the transit time spread that affects electrons as they proceed along the secondary emission stages of the tube. The envelope may be fabricated (as shown at the right) in a cylindrical rather than rectangular configuration for improved vacuum and electrical characteristics.

How it's done:

The left figure shows two electrodes assembled in the high electric field region of a rectangular metal cavity that is resonant at three gigacycles. An external magnet supplies a uniform magnetic field. The length of the pedestal column achieves a ¼-wavelength resonance mode.

In operation, incident light on the photocathode produces photoelectrons that are accelerated initially in the positive-x direction during the positive portion of the microwave voltage cycle. The magnetic field shapes the electron paths as shown, and, during the negative portion of the cycle, the electrons are forced to impinge again onto the active electrode where they produce secondary emission electrons. These secondary electrons are accelerated and their path shaped by the magnetic field to force them back onto the active electrode where additional secondaries are produced.

(continued overleaf)

This process is repeated for n stages, after which the electrons are collected by the coaxial collector assembly.

Notes:

1. The resonant cavity provides the high electric field from a relatively low rf power input.
2. Inquiries concerning this invention may be directed to:

   Technology Utilization Officer
   Goddard Space Flight Center
   Greenbelt, Maryland 20771
   Reference: B66-10526

Patent status:

Inquiries about obtaining rights for the commercial use of this invention may be made to NASA, Code GP, Washington, D.C. 20546.

Source: Hallicrafters Company
under contract to
Goddard Space Flight Center
(GSFC-451)